GUÍA DOCENTE

Curso 2016-2017

1. COURSE DESCRIPTION

Degree:	**Biotechnology**
Double Degree:	
Course:	**Microbial Physiology and Metabolism**
Module:	**Biochemistry and Molcular Biology**
Department:	**Molecular Biology and Biochemical Engineering**
Academic year:	**2016-2017**
Semester:	**2nd**
Total credits:	**4,5**
Year:	**2nd**
Type:	**Mandatory**
Language:	**English**

Teaching model:	**B1**
a. Basic teaching (EB):	**60%**
b. Practical teaching(EPD):	**40%**
c. Actividades Dirigidas (AD):	

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2. EQUIPO DOCENTE

2.1. Course coordinator: Fernando Govantes Romero

2.2. Instructors	
Name:	**Fernando Govantes Romero**
School:	**School of Experimental Sciences**
Department:	**Molecular Biology and Biochemical Engineering**
Area:	**Microbiology**
Category:	**Profesor Titular de Universidad**
Office hours:	**Mondays and Tuesdays, 12 to 1:30 PM and 5 a 6:30 PM. Appointment required**
Office:	**22.03.01G**
E-mail:	**fgovrom@upo.es**
Phone:	**954 977877 (lab at CABD)/954 349160 (office)**

3. LOCATION IN TRAINING PLAN

3.1. Goals

Upon completion of this course, the student will be able to

- Understand the diversity of metabolic activities present in microorganisms, their ecological relevance and their biotechnological applications
- Undertand globally the connections between different components of a metabolic network, their regulation and some examples of directed modification aimed to improve processes of biotechnological interes
- Understand the functioning of some basic physiological processes in microorganisms, such as signal transduction, chemotaxis, solute transport and protein secretion, as well as some of their biotechnological applications
- Understand the basis of microbial stress responses and some of the adaptations found in organisms living in extreme environments, as well as some of their biotechnological applications

3.2. Contributions to training plan

The Biochemistry and Molecular Biology module is central to the Biotechnology degree. According to the VERIFICA report on the degree, the concepts included in this module are: Macromolecules: structure, function and interaction; Enzymology; Structure and function of biomembranes; Transport and Bioenergetics; Metabolic pathways: regulation and control; Biosynthesis of biomolecules: regulation and control; Molecular Genetics and recombinant DNA technology

This course on Microbial Physiology and Metabolism contributes to the understanding of the above concepts, contributing training in the following fields:

- The study of microbe-specific macromolecules, particularly those of potential biotechnological interest
- The study of catabolic and anabolic pathways found exclusively in microorganisms, their regulation and control
- The study of microbial physiological mechanisms of transport, secretion and responses to diverse stimuli

The course will stress the incomparable physiological and metabolic diversity of microorganisms, the possibilities of genetic manipulation to harness such diversity, and the biotechnological applications af microbial physiology and metabolism

This course will provide background required for later courses on Immunology,

Microbial Biotechnology, Biomic analysis, and the optional courses on Environmental Biotechnology, Biotechnology of extremophilic amicroorganisms, Food Biotechnology and Culture of photosynthetic microorganisms

3.3. Recommendations and prior training required

There are no prerequisites for this course, other than coincidence with the class hours of a 1st year course.

Revision of concepts acquired in previous courses on Thermodynamics and Chemical kinetics, Cell Biology, Genetics, Biochemistry (Biomolecules), Biochemistry (Metabolism and its regulation), Genetic Engineering and Microbiology is recommended.

Good command of English language (B2 or higher) is highly recommended

Lab sessions will require the use of a lab coat.

User level informatic skills and and the use of the e-learning platform Blackboard is highly recommended.

4. COMPETENCES

4.1 Degree competences developed in this course

- Starting with the skills acquired during secondary education, knowing and understanding completely the basic facts, concetpts, principles and theories related to the study of living things and their interactions with human activities
- Knowing and understanding general biological processes from a molecular, cellular, physiological and, when required, ecological perspective.
- Knowing and understanding the information obtained from biological processes and their adjustment to the theoretical framework of each of the courses.
- Using terminology, nomenclature and classification systems for each of the courses in a rigorous fashion.
- Acquiring basic experimental skills appropriate for each of the courses, by means of description, quantification, analysis and critical assessment of experimental results obtained in an autonomous fashion
- Using up-to-date scientific and technical literature, acquiring the ability to perceive clearly the current advances and possible future developments.
- Working appropriately in a Biology, Chemistry or Biochemistry laboratory, knowing and applying the regulations and techniques related to safety and higyene, handling laboratory animals and waste management.
- Knowing and applying the experimental tools, techniques and procedures in a laboratory setting.
- Culturing and handling animal, plant and microbial cells
- Acquiring the skills of observation and interpretation of results obtained.

4.2. Module competences developed in this course

- The student will be able to measure an array of metabolic abilities, understand and interpret the results derived from such assays as they relate to defined metabolic pathways, organisms and growth conditions, both in nature and in experimental situations, and connect them with biotechnological applications such as degradation of pollutants and production of metabolites of interest.
- The student will be able to understand and interpret experimental results aimed to elucidate the regulation of microbial metabolism and predict the results of the directed modification of metabolic pathways and their regulation as it relates to processes of biotchnological interest.
- The student will be familiar with some assays of physiological activities (transport, chemotaxis), and will be able to understand and interpret experimental results aimed to elucidate the mechanisms underlying diverse microbial physiological processes, and propose biotechnological applications for some of these processes.

4.3. Course-specific competences

- The student will be able to measure an array of metabolic abilities, understand and interpret the results derived from such assays as they relate to defined metabolic pathways, organisms and growth conditions, both in nature and in experimental situations, and connect them with biotechnological applications such as degradation of pollutants and production of metabolites of interest.
- The student will be able to understand and interpret experimental results aimed to elucidate the regulation of microbial metabolism and predict the results of the directed modification of metabolic pathways and their regulation as it relates to processes of biotchnological interest.
- The student will be familiar with some assays of physiological activities (transport, chemotaxis), and will be able to understand and interpret experimental results aimed to elucidate the mechanisms underlying diverse microbial physiological processes, and propose biotechnological applications for some of these processes.

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BLOCK 1. Microbial metabolism

1. An introduction to microbial metabolism

1.1. Matter metabolism
2. Central metabolism
3. Catabolism
4. CO_2 fixation and assimilation of C_1 compounds
5. Assimilación of inorganic sulfur and nitrogen
6. Anabolism y secondary metabolism

1.2. Energy metabolism
6. Respiration
7. Fermentation
8. Photosynthesis and phototrophy
9. Chemolithotrophy

BLOCK 2. Microbial physiology

11. An introduction to microbial physiology

2.1. Basic physiological mechanisms
12. Cell cycle and cell division
13. Solute transport
14. Protein secretion
15. Motility

2.2. Physiological and environmental responses
16. Chemotaxis
17. Responses to environmental stress
18. Mechanisms of antimicrobial resistance
19. Complex and developmental responses
20. Microbial lifestyles

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Instruction is structured in the following activities:

• Lectures (21 hours): Lectures given by the instructor will provide concepts, interactive activities and other sources of information for the course.

• Lab sessions (13.5 hours): Lab sessions will be structured in two practice activities:
- (1) Microbial metabolism: 7.5 hours (two 3-hour sessions plus one 1.5-hour session)
- (2) Basic physiological functions: 6 hours (two 3-hour sessions)

• Tutoring sessions: We encourage both face-to-face tutoring and virtual tutoring. Face-to-face tutoring sessions may be individual or collective and must be appointed in advence with the instructor. Virtual tutoring will be performed by means of the Blackboard communication tools or the instructor's e-mail.

• Individual work by the student: The student is expected to study for the exams and complete online quizzes and problems within the deadlines set by the instructor.

• Resources for the student

- Basic bibliography
- Virtual classroom (Blackboard Learn): The virtual classroom will be used to fill out the assessments and hand in assignments. The student will use the virtual classroom to gain access to the following resources:

- Supporting materials aimed to integrate course contents with contantes of previous courses
- Powerpoint presentations of instructor's lectures
- Additional bibliography
- Discussion boards
- Links to web sites of interest

7. GRADING

Provided its high degree of experimentation, this course conforms to item 8.2.d of the Regulations of Evaluation of Degree Students at Universidad Pablo de Olavide. Accordingly, **there will be no evaluation by means of a single test.**

Basic teaching: The basic knowledge acquired by the student will be assessed by means of an exam per theme block, graded on a 1 to 10 scale. The Basic Grade (BG) will be the average of both exams, provided that they are both ≥5.0. BG represents 40% of the final grade, and must be above 5.0 to pass the course. Failed exams may be re-taken separately in final June exam, but not in further exams.

Practical teaching: Lab skills will be assessed by means of an exam per practice, graded on a 1 to 10 scale. The Practical Grade (PG) will be the average of both exams, provided that they are both ≥5.0. PG represents 20% of the final grade, and must be above 5.0 to pass the course. Failed exams may be re-taken separately in final June exam, but not in further exams. Unjustified absence to lab sessions will be penalized with -2 points in the PG per session missed.

Quizzes: A quiz will be published for each lecture to be filled out by the students on the virtual classroom. The grade obtained will be 20% of the final grade.

Problems: A set of problems related to the basic contents will be published the end of each theme block. The studente will fill out an answer sheet on the Virtual Classroom. Problems are expected to be solved in a cooperative fashion, and discussion and debate among the students and with the instructor is strongly encouraged. The grade obtained will be 20% of the final grade.

Participation: Students showing special interest in this course, as assessed from participation in classroom and lab sessions, tutoring sessions and discussion boards, may obtain a bonus in the final grade of up to 5%.

According to university regulations, the equivalence of numaerical grades with grading categories is as follows:
-Suspenso: Grade < 5.0
-Aprobado: 5.0<Grade<7.0
-Notable: 7.0<Grade<9.0
-Sobresaliente: Grade >9.0

The distinction "Matrícula de Honor" will be awarded if appropriate to those students showing an extraordinary performance in the course, according to the instructor's criteria. The number of "Matrículas de Honor" will not exceed 5% of the matriculated

students.

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Physiology and Biochemistry of Prokaryotes, 3rd Edition. 2007. D. White. ISBN: 195301684. Oxford University Press.

Microbial Physiology, 4th Edition. A. G. Moat. ISBN: 0-471-39483-1. Wiley.

Bacterial Physiology and Metabolism. B. H. Kim, G. M. Gadd. 2008. ISBN: 978-0-521-8463-3. Cambridge University Press.

Microbial Physiology and Metabolism, 2nd Edition. 2000. D. R. Caldwell. ISBN: 0-89863-208-0. Star Publishing.

Brock. Biología de los microorganismos, 14ª edición. M. T. Madigan. 2015. ISBN: 9788490352793. Pearson.

Microbiología. 7ª Edición. 2009. L. Prescott, J. Harley, D. Klein. ISBN: 9788448168278. McGraw-Hill Interamericana.